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## Department of Energy

ROCKY FLATS OFFICE  
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GOLDEN COLORADO 80402-0928

ADMIN RECORD

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## ACTION

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NOV 23 1993

93-DOE-13049

Mr Martin Hestmark  
U S Environmental Protection Agency, Region VIII  
ATTN Rocky Flats Project Manager, 8HWM-FF  
999 18th Street, Suite 500  
Denver, Colorado 80202-2405

Mr Gary Baughman  
Hazardous Waste Facilities Unit Leader  
Colorado Department of Health  
4300 Cherry Creek Drive South  
Denver, Colorado 80222-1530

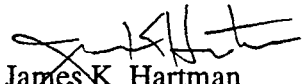
Gentlemen

This letter transmits your agencies comments and Rocky Flats Office's (RFO) responses to those comments on Draft Final Technical Memorandum (TM) No 3, Human Health Risk Assessment, Walnut Creek Priority Drainage, Operable Unit (OU) No 6, Model Description. The DOE/RFO believes that your agencies comments have been fully addressed and clarified. We also will be working closely with your staff so that the document can be revised and approved in a timely manner.

This submittal to your organizations is for your review and comment, and to resolve any outstanding comments in order to finalize TM No 3 without any additional submittals. Therefore, DOE/RFO requests agency response on the comment/response transmittal by November 29, 1993.

Please contact Norma I Castaneda at 966-4226 if you should have any questions on this transmittal.

Sincerely,

  
James K. Hartman  
Assistant Manager for Transition  
and Environmental Restoration

Enclosure

DOCUMENT CLASSIFICATION  
REVIEW WAIVER PER  
CLASSIFICATION OFFICE

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-ATS/T130GReviewed for Addressee  
Corres Control RFP11-24-93  
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Ref Ltr #

OE ORDER # 5400 1

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M Hestmark & G Baughman  
93-DOE-13049

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cc w/Attachment  
J Ciocco, EM-453 1  
B Fraser, EPA  
H Ainscough, CDH

cc w/o Attachment.  
A Rampertaap, EM-453  
R Schassburger, ERD, RFO  
N Hutchins, EG&G  
E Mast, EG&G  
R Roberts, EG&G  
B Magee, HAZWRAP

## EPA COMMENTS

| Item or Section | Comment  | Resolution  |
|-----------------|--|---|
| 10<br>1         | <u>General Comments</u><br><br>The conceptual model should include at least a brief characterization of the contaminant sources present at OU6. For instance, this section lacks a discussion of whether any contaminants are likely to be present as immiscible phases in the subsurface. If contaminants are likely to be present as dense nonaqueous phase liquids, the scope of modeling effort will have to be expanded to consider multiply pathways at each subsite, particularly some that involve subcropping sandstones.   | A brief discussion of the potential contaminant sources at OU 6 will be added.  |
| 10<br>2         | The intent of Section 2.0 General Conceptual Model of Operable Unit 6, is to identify and describe potential exposure scenarios for present and future human receptors in OU6. The exposure pathways should be updated as necessary to be consistent with Tech Memo 2 for OU6.   | The exposure scenarios and exposure pathways to be used at OU 6 are delineated in Technical Memorandum #2 "Exposure Scenarios." Any changes due to comment resolution on technical memorandum #2 will automatically apply to technical memorandum #3.   |
| 20<br>1         | The limitations, assumptions, and uncertainties associated with the use of the ONED3 groundwater model at OU6 have not been provided, as required by the IAG. The OU6 shallow groundwater system is a variably saturated heterogeneous, anisotropic, unconfined aquifer of limited extent. Most of the various contaminant sources at OU6 are unlikely to fully penetrate the aquifer. Application of the model ONED3 to the shallow groundwater system at OU6 will violate most of ONED3's underlying assumptions, as listed in the ONED3 model documentation (Bejin and van der Heyde 1993). The model assumes | Because the objective of the modeling is to support the OU-6 Human Health Risk Assessment, and limited OU-6 hydrogeologic and contaminant information is available to support a complex two- or three-dimensional numerical modeling approach, a conservative analytical modeling approach was selected for groundwater fate and transport modeling at OU-6. This is appropriate because the degree of model complexity need only be sufficient to provide conservative (i.e. relatively higher) estimates of contaminant mass loading to Walnut Creek than would be simulated by a more complex model. |

| Item or Section | Comment   | Resolution  |
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|                 | <ul style="list-style-type: none"> <li>• A uniformly porous confined aquifer</li> <li>• A homogeneous and isotropic aquifer with respect to its hydraulic and transport characteristics</li> <li>• A semi-infinite aquifer in extent (in the positive x-direction) of constant thickness</li> <li>• A source fully penetrates the aquifer</li> <li>• A fully saturated groundwater flow regime</li> <li>• One-dimensional, steady-state, uniform, regional flow away from the source</li> <li>• The density and viscosity of the solute in the source and in the aquifer are identical and do not change with time</li> <li>• No solute advection of dispersion into or out of the confining layers</li> </ul> <p>The OU6 model description must list the model's underlying assumptions and discuss how violating the assumptions will affect the model results, show how uncertainty will be accounted for, and provide a justification for selection this model for risk assessment purposes despite the disparity between assumed and actual conditions</p> | <p>ONED3 was selected as the model code based on criteria specified in TM-3. ONED3 is similar to other analytical transport models in its governing equations and underlying assumptions and in its limitations. In general, limitations imposed by the underlying assumptions can be addressed by making conservative assumptions in the application of the model to OU-6, thus reducing the importance of model uncertainties with respect to risk assessment needs.</p> <p>The following discussions address the model assumptions listed in comment 1.1</p> <p><u>A uniformly porous confined aquifer</u> - The primary limitation of this assumption is that it implies aquifer thickness is constant a condition not necessarily true in all cases for an unconfined aquifer. However, for the purpose of this study, steady-state conditions will be assumed for the OU-6 groundwater flow systems. Under steady-state conditions with no aquifer stresses (i.e., no pumping) unconfined aquifers also have constant thickness and, thus, the assumption of confined conditions is not a limitation.</p> |

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|                 |         | <p>In reality at OU-6, the groundwater flow systems are probably highly transient varying substantially in thickness during the year in response to local recharge events in some cases possibly even becoming unsaturated at times. However contaminant movement through the transient OU-6 systems is probably slower than would occur if the flow systems were steady-state and of constant thickness equal to the average of the variable thicknesses. Therefore the ONED3 model which will assume steady-state conditions and no aquifer stresses should result in conservative (i.e. faster) estimates of contaminant movement relative to actual conditions. Moreover, when converting ONED3 simulated concentrations to mass loading rates at discharge points along Walnut Creek a conservatively high value of groundwater flow rate will be applied to result in conservative estimates of loading.</p> <p>A homogeneous and isotropic aquifer with respect to its hydraulic and transport characteristics - Limited data from the Phase I investigation are available for OU-6 to characterize aquifer heterogeneity and anisotropy. Thus conservative values for hydraulic conductivity, effective porosity, dispersion coefficient, and soil bulk density will be applied to result in conservative model simulation results.</p> <p><u>A semi-infinite aquifer in extent (in the positive x-direction) of constant thickness</u> -The OU-6 model simulations will conservatively assume steady-state conditions, no aquifer stresses (e.g. pumping), and homogeneous conditions</p> |

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|                 |         | <p>Under steady-state conditions with no aquifer stresses (i.e., no pumping) unconfined aquifers also have constant thickness. Therefore model boundary influences will be negligible in the OU-6 modeling, and will not adversely affect the conservative nature of the model results.</p> <p>A source fully penetrates the aquifer - For the purposes of modeling identified groundwater contamination areas will be used as the contamination source areas. The identified groundwater contamination areas will be assumed to extend throughout the entire thickness of the saturated zone (i.e. fully penetrating) at the measured concentrations and to exist throughout the entire simulation period. This will result in conservative estimates of contaminant loading to Walnut Creek.</p> <p>A fully saturated groundwater flow regime - In reality in some cases, portions of the OU-6 flow systems may become partially saturated during dry times of year. Because contaminant migration rates are higher under fully saturated conditions than under partially saturated conditions other things being equal, the assumption of fully saturated conditions in the ONED3 model will result in conservative estimates of contaminant migration.</p> <p><u>One-dimensional, steady-state, uniform, regional flow away from the source</u> - The assumption of these conditions is conservative in that it maximizes contaminant migration rates from source areas to discharge points along the creek. Use of two- or three dimensional flow, or transient conditions would likely result in slower (less conservative) simulated transport rates.</p> |

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|                 |   | <p>The density and viscosity of the solute in the source and in the aquifer are identical and do not change with time - Based on the low concentrations of contaminants detected in groundwater to date (i.e., the low µg/L range) affects due to density or viscosity differences between the solute and water are not of concern This assumption is reasonable for OU 6 conditions</p> <p>No solute advection or dispersion into or out of the confining layers - As discussed in TM-3, commingling of contaminant plumes from different source areas along complex flow paths is not believed to be prevalent at OU 6 Therefore advection and dispersion of solute into a model domain from a source outside of the model is not a substantial concern Advection/dispersion of solute to above the water table or into the claystone bedrock is unlikely Advection and dispersion of solute out of the model domain would tend to reduce contaminant concentrations simulated at the creek Therefore the assumption of no advection or dispersion out of the model is conservative Contaminants will not migrate ss/ls bedrock</p> |
| 202             | <p>The IAG requires that the model description include a summary of the data to be used with the model The only information provided is the parameter values and ranges given in Table 3-1 This table consists of textbook values Table 3-1 should be replaced with tables that summarize field-derived or locally representative values of hydraulic conductivity, effective porosity and bulk density if they are available If not, it should be explained where these parameters will be obtained and why they will be adequately representative of site conditions The OU6 model description gives no information on how the contaminant source terms will be configured in time and space and how this information will be input into ONED3 This information is critical to the model description and should be briefly explained here</p> | <p>Table 3-1 states that parameter values for groundwater modeling will be based on literature values and site-specific OU-6 and OU 2 data Where OU-6 data are available from the RT/RI investigation they will be used to specify or develop model parameters Where appropriate OU 2 data will also be used to supplement the OU-6 data Literature values will be used for certain chemical-specific parameters (e.g. oceanol-water coefficient degradation half-life) and where site-specific data are unavailable or highly uncertain</p>  |

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|                 | <p>Finally, an adequate description of the model should show locations and distances of groundwater pathlines, discharge points to surface water or human receptors, and the length of time the simulations will be run</p>  | <p>The draft version of TM-3 did not contain specific model details such as contaminant source term configurations groundwater pathlines, discharge points to surface water or human receptors and the length of time the simulations will be run because compilation and analysis of data from the RFI/RI investigation is ongoing and had not progressed to the point where model details could be included. A map showing source areas potential groundwater flow and contaminant migration pathlines and discharge points to surface water and potential human receptors will be prepared. If the necessary data are available in time this map will be included in the final version of TM 3. If not it will be submitted separately to EPA when completed. A detailed description of all modeling procedures input parameters and conditions, and results will be included in the OU-6 RFI/RI Report.</p> |
| <p>203</p>      | <p>ONED3's governing equations and initial and boundary conditions should be presented in this document or specific references provided. The governing equations and initial and boundary conditions constitute the mathematical framework of a model and are an integral part of the model description. This information is necessary for model evaluation.</p> | <p>ONED3's governing equations and underlying assumptions are described in the model documentation (Belgin M.S. 1989. SOLUTION: A Program of Analytical Models for Solute Transport in Ground Water. International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado). A copy of the model documentation has been provided to EPA for review.</p>  |

| Item or Section                                    | Comment   | Resolution  |
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| <p>Section 3.2.1,<br/>Page 3-3 Paragraph<br/>1</p> | <p>The text states "available site-specific data and fate and transport parameters, source areas, and hydrogeologic conditions will be integrated using ONED3 to simulate the fate and transport of dissolved-phase contaminants in the saturated zone from source areas through the alluvium and colluvium, to discharge points along Walnut Creek."</p> <p>This statement appears to discount the possibility that contaminants can move from alluvium and colluvium into subcropping sandstones and then discharge into Walnut Creek. This situation appears to exist in nearby portions of OU-2 in hydrogeologic settings similar to portions of OU-6. This situation must either be accounted for or justification provided for concluding that the bedrock pathways can be neglected without jeopardizing the utility of the model results. In addition, the sources of the site-specific data on fate and transport parameters, source areas, and hydrogeologic conditions should be provided. A summary of these data would be useful in this document.</p> | <p>The hydrogeology of OU-6 differs substantially from that observed at OU-2. Based on the available OU-6 hydrogeologic data subcropping Arapahoe No. 1 Sandstone, which underlies portions of the alluvium and colluvium at OU-2, does not appear to be present at OU-6. Based on available data, the shallow groundwater system at OU-6 appears to consist of areas of saturated alluvium and/or colluvium overlying claystone bedrock. Data collected for OU-2 indicates that claystone, in general, has low permeability there, therefore, potential migration of contamination through subcropping sandstone or claystone bedrock pathways does not appear to be of concern at OU-6.</p>             |
| <p>Section 3.2.1<br/>Pages 3-3 paragraph<br/>2</p> | <p>The text states "contaminant fate and transport will also be evaluated using water balance and chemical mass balance analyses as a check for the reasonableness of the ONED3 results." The sources and validity of data for each component of the water and mass balance should be discussed.</p>  | <p>The results of the ONED3 model will be simulated concentrations of contaminants at the points where groundwater discharges to Walnut Creek. In order to estimate contaminant mass loading, this assumption is not a significant limitation to the creek, which is the input parameter required for the surface water model estimates of groundwater discharge rates will be necessary (i.e., the contaminant mass loading = the contaminant concentration multiplied by the discharge rate). The water balance analysis referred to in TM-3 will be used to estimate groundwater discharge rates. The discussion of chemical mass balance analyses will be removed from the final version of TM-3.</p> |

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| 301             | <p>The surface water model description lacks a clear definition of the model inputs. The text only states "model inputs will be a time series of precipitation and groundwater seep flows/loads" and "the time step is anticipated to be daily, or possibly smaller as appropriate to describe rainfall/runoff and erosional processes". The OUV6 model description should indicate how data will be input into the model and include a discussion of the data sources and time step(s) to be used, and the types and recurrence intervals of storm events that will be simulated. It should also discuss how seepage and base flow will be determined and input.</p> | <p>HSPF9 inputs will be sequential times series of meteorological data, including precipitation, air and dew point temperatures, solar radiation, wind speed, and evaporation. Except for the evaporation times series, the time series are obtained from Rocky Flats Plant meteorological tower as 15 minute readings and aggregated to a 1 hour interval by summing or averaging the 15 minute readings. The evaporation time series is developed from the other series mentioned using aggregated daily values as input. The resulting daily evaporation values are then disaggregated to obtain hourly values. It was necessary to use daily values to develop the evaporation time series as the calibration criteria against which the series was developed has a daily resolution.</p> <p>A 1 hour input (simulation) time step was chosen so that the effects of temporally short, but relatively intense meteorological events will not be obscured as may occur if the meteorological conditions were considered on a mean daily basis. Output can be obtained at any aggregation of the simulation interval. Daily summaries will be used as 1 hour to 1 hour comparisons of simulated versus observed values requires extremely detailed boundary condition development and determination of localized variations that are beyond the scope of this project. Further, though it would be possible to attempt flow calibration at this time scale, there are no water quality data available at this time resolution for use in such a model calibration. Given that the water quality data are point readings, daily summaries of simulation are the preferred method.</p> |

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|                 |  | <p>The simulation time frame to be used is July 1, 1989 to June 30, 1993. This time frame was selected as it encompasses the period where flow and water quality data is available in sufficient quantity and quality for use in model calibration. The four years meteorological data averages are considered typical for this region and include an event with a greater than ten year recurrence interval. Simulating specific recurrence intervals are not in the scope of this project.</p> <p>Seepage and baseflow are to be added to the model as sequential time series. The seepage time series is a "boundary condition" that may be modified during the calibration process. Initial estimates of seepage will be obtained from a site-wide groundwater flow model that is currently under development and modified during model calibration if necessary. Baseflow data is a boundary time series that is available from pond operation records and flow recording instrumentation.</p> |
| 3<br>0<br>2     | <p>The model description must specify what data will be used with the model and the sources from which it will be obtained. Table 3-2 should include available field-derived values for the model parameters as well as the contamination input values and other boundary conditions or show where adequately representative values for these parameters will be obtained.</p> | <p>The summarizing of field-derived values is part of the actual modeling process and should not be undertaken until model development is complete. This development process requires knowledge of the chemicals of concern to be simulated before initial and boundary conditions can be addressed and field-derived values selected. It is inappropriate at this stage to determine field-derived values for the model parameters.</p>  |
| 3               | <p>The major contaminant transport and hydrologic equations used by the model should be presented in this report or specific references provided for where they can be obtained.</p>   | <p>HSPF is a comprehensive watershed level/water quality model that incorporates several decades of prior hydrologic/water quality research. The underlying mathematical equations are contained in numerous references and are not assembled together in any one document. The final TM will provide more extensive discussion of the underlying theory.</p>   |

| Item or Section                        | Comment  | Resolution  |
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| 4 Section 3.3.1, Page 3-6, Paragraph 3 | The flow routing technique used with HSPF9 assumes complete mixing in all surface impoundments. However, if larger lakes or reservoirs with seasonal stratification are being simulated with HSPF9, then this model would not accurately handle pollutant fate and transport mechanisms. Therefore, this model should only be used for portions of watershed that do not contain stratified impoundments.  | Rocky Flats Plant's reservoirs are assumed to be fully mixed based on their depth and turnover ratios.  |
| 5 Table 3-2                            | The partitioning coefficient between dissolved and suspended states (K <sub>D</sub> ) is listed as having no units. If defined like other commonly used partitioning coefficients, this should have actual units. Actual units should be listed on this table, or this parameter should be more explicitly defined.  | The listing of partitioning coefficient K <sub>D</sub> with no units and a range of 0-1 is in error. K <sub>D</sub> is the distribution coefficient for the constituent between the dissolved state and adsorbed state (suspended and/or bed sediment associated). The units are in liters/mg with a minimum value of $1 \times 10^{-10}$ and no maximum value. |
| 6 Table 3-2                            | The partitioning coefficient (K <sub>D</sub> ) has a range of values listed as "0-1". However, many contaminants exhibit ratios between dissolved and suspended states that would be much greater than 1. Either this software is incapable of handling partitioning of many contaminants or this range is incorrectly listed. Therefore, either the table listing should be corrected, or the parameter definition should be explicitly stated, or the model has a very limited range of usage that excludes many organic contaminants. | The listing of partitioning coefficient K <sub>D</sub> with no units and a range of 0-1 is in error. K <sub>D</sub> is the distribution coefficient for the constituent between the dissolved state and adsorbed state (suspended and/or bed sediment associated). The units are in liters/mg with a minimum value of $1 \times 10^{-10}$ and no maximum value. |

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| <p>4 0 1 Section<br/>3 5 1, Pages 3-13<br/>and 3-14</p> | <p>The Box Model is proposed to calculate contaminant concentrations under the following two scenarios (1) the transport of volatile organic compounds into a building and (2) the transport of particulate matter to on-site receptors</p> <p>The Box Model may not be the most appropriate choice for either scenario In scenario number 1, the Box Model may not accurately estimate concentrations for an enclosure such as a building Under these conditions it may be difficult to accurately estimate the mean wind speed, a critical mathematical parameter in the Box Model</p> <p>In scenario number 2, other models such as the Industrial Source Complex Short Term (ISCST) may yield more accurate estimates than the Box Model This is especially true if the distance from the emission source (the contaminated soil) and the receptors exceeds 100 meters</p> <p>The text did not, but should, list the precise algorithm used for the Box Model since several variations exist The text should also include a mathematical justification for these algorithms</p> | <p>Both of the scenarios cited in this comment are for receptors immediately above or on the areas of contamination of concern The use of ISCST or other typically approved EPA models is not appropriate for estimating the impacts for receptors located within 100 meters of an emission source since predicted impacts tend to increase unrealistically as a result of forcing the interpolation of values for the internal dispersion parameters at inappropriately small distances For this reason the ISC model typically ignores estimates of impact contributions from emission sources on receptors less than 100 meters away The distance between emission sources and on-site receptors for the OU 6 modeling is much less than 100 meters which precludes the use of EPA-approved Gaussian models</p> <p>The Box Model is typically used to estimate on-site air quality impacts only where receptors are located within the immediate areas of the emissions source The Box Model estimates impacts by the use of one basic equation that estimates a concentration within a volume centered directly above the emission source of interest that is a function of wind speed, emission rate and the physical dimensions of the volume This equation is</p> |

| Item or Section | Comment | Resolution   |
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|                 |         | <p> <math>C_i = E_i / UA</math><br/>           where<br/> <math>C_i</math> - concentration of chemical component i, in grams per cubic meter<br/> <math>E_i</math> - emission rate of chemical component i in grams per second<br/> <math>U</math> - wind velocity through the volume, in meters per second<br/> <math>A</math> - cross-sectional area of the volume, in square meters         </p> <p>           This equation is widely published and has been accepted for use by EPA for near-source impacts. One citation of this equation can be found on page 88 of Volume II - Estimation of Baseline Air Emissions at Superfund Sites of the Air/Superfund National Technical Guidance Study Series EPA-450/1-89-002a. For the building scenario the box model equation will be modified by using an appropriate value of the passive air exchange rate within the building to estimate a volumetric flow rate that is substituted for the product of the <math>U \times A</math> term in the denominator.         </p> |

| Item or Section                                 | Comment  | Resolution  |
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| <p>2 Section 3.5.1,<br/>Pages 3-13 and 3-14</p> | <p>The Fugitive Dust Model (FDM) is proposed to calculate contaminant concentrations of particulate matter to off-site receptors. The FDM is a widely used model to derive exposure point concentrations. However, due to the complex algorithms used, the FDM is not as efficient as other models. This is particularly true when multiple contaminant sources are involved, which is possible in the present modeling. It can take days to complete one computer run. Also, EPA in Region 8 prefers the use of the ISC3 model.</p> | <p>As described in the technical memorandum for the model description, FDM has an improved algorithm for gravitational settling and deposition as compared to the ISCST and is more suited for treatment of fugitive dust emission sources. Validation studies for FDM have indicated that modeled particulate concentrations from fugitive dust sources agree much more significantly with concurrently monitored particulate concentrations than ISC. These studies, conducted by TRC (EPA, 1989), concluded that FDM is a more suitable model for predicting particulate impacts from fugitive dust emission sources than from other available, EPA-approved models such as ISC on the basis of the following reasons:</p> <ul style="list-style-type: none"> <li>Existing ISC model algorithms produce physically unrealistic estimates of impacts</li> <li>The virtual point source approach in ISC-LT2 cannot handle complex source/receptor geometries</li> </ul> <p>In addition, FDM has been improved to incorporate an integrated line source algorithm. Recent work has been conducted to revise the ISCST model so that it is more appropriate for modeling fugitive dust impacts from large surface coal mines. One of the revisions includes changing the deposition algorithm in ISCST so that it is more consistent with the technique used in FDM.</p> |

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|   |   | <p>The statement that execution time for FDM can be inordinately long is true under certain scenarios when hourly meteorological data is used with numerous sources with several particle sizes and corresponding gravitational settling velocities and a receptor grid containing a large number of receptors. However, if ISCST were used with the same data input configuration, its execution time would also be long since specifying several particle size categories and settling velocities effectively increases the execution time in proportion to the average number of particle size categories used for each source. In the OU-6 air modeling study, the number of receptors will be small (probably ten or less) and will be executed in a long-term mode with a joint frequency distribution, rather than hourly meteorological data. Recent experience with executing FDM for OU-2, a modeling scenario with a similar number of sources and receptors indicated reasonable execution times.</p> |
| <p>3 Section 3.5, Pages 3-13 through 3-16</p> | <p>It is unclear if the modeled concentrations are calculated from the cumulative effects of all the defined sources. This document may calculate contaminant concentrations individually from the sources. The contaminant concentrations should be calculated from the aggregate effect of all the defined sources. Also, the OU6 model description did not, but should clearly define all input terms used for the Box and FDM models.</p> | <p>The modeling of particulate (radionuclide) impacts at off-site receptors at the perimeter of OU-6 will be performed by dividing the entire area of OU-6 into areas representative of a specific radionuclide soil concentration and estimating the cumulative impact of wind erosion from all these separate area sources. Thus, ambient radionuclide modeling at the off-site receptors will consider the cumulative impacts from all radionuclide-bearing surficial soils on OU 6.</p>   |

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|                 |         | <p>On-site ambient radionuclide impacts from OU-6 will be modeled by designating an area that conservatively represents observed surficial soil concentrations of radionuclides. The radionuclide soil concentration used for this representative location will be obtained from estimating the reasonable maximum exposure (RME) of all surficial soil radionuclide concentrations sampled on OU-6. The size of the area will correspond to an average size of one of the areas designated in the off-site particulate (radionuclide) modeling. A similar approach will be used for estimating VOC concentrations within an on-site building. RME values of sub-surface soil and groundwater VOC concentrations will be used to estimate an ambient VOC impact within an on-site building, located on OU-6. Using a RME value (95% percentile value of the mean of a data set) will provide a conservative estimate of potential VOC impacts within an on-site building that could be located anywhere within OU-6.</p> <p>The basis of the data used as inputs for the air models mostly will be from recent OU-6 soil sampling and groundwater monitoring programs performed in anticipation of the OU-6 RFI/RI report. These data will include</p> <ul style="list-style-type: none"> <li>• Surficial soil sampling for metals, radionuclides, semi-volatiles and volatile organic compounds from all the IHSS's located within OU-6, surficial soil characteristics and concentrations will be estimated from these sampling data for the ambient radionuclide modeling.</li> </ul> |

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|                 |         | <ul style="list-style-type: none"> <li>Groundwater concentration data gathered from the recently installed eleven monitoring wells on OU-6 for metals, radionuclides, semi-volatiles and volatile organic compounds. Groundwater concentrations from these data will be used to provide estimates of liquid-phase concentrations for the on-site building modeling.</li> <li>Sub-surface soil concentration data for the on-site building modeling will be obtained from soil boring sampling conducted at locations near the surficial soil sampling locations on the OU-6 IHSS's.</li> </ul> <p>Comparisons of the modeled off-site ambient radionuclide impacts to concurrently monitored RAAMP (i.e., during the 1992 meteorological monitoring year consistent with the time frame of the meteorological data set used in the FDM modeling) data will be performed as a reality check.</p> <p>Meteorological data for the FDM modeling will be from the 61m tower in the west buffer zone, located on the west side of the Rocky Flats Plant, for the calendar year, 1992. Data from the ten meter level will be merged with concurrent mixing height data from Stapleton International Airport. Stability class will be determined from sigma theta and wind speed measurements obtained from West Buller Zone database. Meteorological data from this site is deemed representative of conditions in the vicinity of OU-6 and meet EPA quality control and quality assurance criteria.</p> |

## CDH COMMENTS

| Item or Section | Comment  | Resolution  |
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| General Comment | On the surface the selected air models will probably be acceptable for the OUG area, however, the input data should be monitored carefully   |   |
| Section 3 2 1   | <p>The choice of ONED3 as a contaminant transport model needs more justification. The hydrologic conditions of the colluvium violate almost every assumption the model depends upon: uniformly porous, confined aquifer, homogeneous, isotropic, constant thickness, fully saturated, no density/viscosity differences between source and aquifer, no solute advection or dispersion into or out of the confined aquifer. The text should discuss why these assumptions can be ignored. ONED3 gives concentration as output, the water balance is totally irrelevant to the model. Is the use of this model entirely theoretical or will some of the results be compared to data?</p> <p>In the second paragraph, page 3-3, it is stated that a water balance and chemical mass balance will be performed to check the reasonableness of the model results. It is not clear that the water balance is part of the conceptual model rather than a check on model output. There is no discussion on how the water balance will be done. What will be included? Very little field data exists for inflow and outflow, the methods used to estimate these flows differ in their complexity and accuracy. What will be done to check the reasonableness of the water balance estimate? The method to be used for the chemical mass balance is not discussed either. What assumptions and data will be used to calculate the mass balance?</p> | <p>Please see the resolution to EPA's comment (see page 1 of 19, Section 2 0 1). See also the resolution to EPA's comment, page 7 of 19, 5 0, Section 2 2 1, page 3 3, paragraph 2.</p> |

| Item or Section | Comment   | Resolution   |
|-----------------|---|--|
| Section 3.5.2   | <p>The Model Selection Criteria Evaluation, Selection Criteria 3 and 4 page 3-16 states, " the FDM model has undergone considerable validation and verification " While there has been a considerable amount of work done on and with the FDM model, neither the reviewer, nor the Air Pollution Control Division (APCD) staff, is aware that the model has been validated</p> <p>The FDM is usable when applied to small areas of relatively flat terrain but does have problems with complex terrain If the FDM is used, the 1991 update version should be used</p> | <p>Since the FDM is on the EPA Bulletin Board for use as a public domain air quality model, it has been used in numerous regulatory applications and considerable study had been performed demonstrating its better agreement with monitored data as compared to other EPA-approved models such as ISCST, we had assumed that EPA had accepted FDM as a validated model However within the limited area around OU 6 that FDM will be applied we believe that it is the appropriate choice for modeling fugitive dust emission impacts at off-site receptors that are located within a relatively flat terrain area In addition, ongoing studies have been performed to further improve FDM Eventually, the superior deposition algorithm found in FDM will be incorporated into an improved version of ISCST that will be distributed for public use in the future, but not soon enough for the OU-6 modeling The most recent 1993 version of FDM available on the EPA Bulletin Board will be used for OU-6 modeling</p> |
| Section 3.6     | <p>Under the Summary of Parameter Values on page 3-17 is a discussion of the meteorological data to be used The "met" data from the site if validated, however, consideration should be given to working in the data collected by APCD's three sites on the perimeter of the plant The data for these sites has been provided to the Plant and additional copies are available if requested from APCD The data from 1992 would be better for use in the model than 1991, although either would be acceptable</p>  | <p>The 1992 meteorological data set from the West Buffer Zone, located on the west side of the Rocky Flats Plant, has been compiled, validated and formatted for use as a modeling data set Although, minor short-term variations in wind flow patterns may exist between the West Buffer Zone and the three APCD sites cited in the above comment, it is doubtful that significant differences in long-term (annual) average ambient concentrations at the off site receptors and in representation of conditions around OU-6 would result from using the different data sets The use of multiple meteorological data sets to model impacts from OU-6 to the relatively close location of the off-site receptors is not warranted</p>   |

| Item or Section | Comment   | Resolution  |
|-----------------|---|---|
| Table 3         | In the table effective porosity and bulk density are listed but they are not used in ONED3, what model will they be used in?  | ONED3 requires input of a pore velocity value. Pore velocity for ONED3 is equivalent to effective porosity. Bulk density is used to calculate retardation factor from the distribution coefficient, $K_d$ . Retardation factor is an input to ONED3.  |
| Table 3-4       | In this table under "Source" the document states, RFP Site Environmental Report for 1990 (EG&G 1991a) "would be used for "Joint frequency distribution of stability class, wind speed and direction". There should be a later report which would be better. | At the time that this technical memorandum was being prepared, the West Buffer Zone meteorological data for 1992 was not yet available. This data will be used for the OU-6 modeling and the joint frequency distribution of stability class, wind speed and direction presented in the OU-6 RFI/RI report will also be based on the West Buffer Zone data set. |

|   |                 |                |
|---|-----------------|----------------|
| POSTNET brand fax transmittal memo 7671 |                 | # of pages > 5 |
| To                                      | ED Mast         |                |
| Co                                      | EG&G            |                |
| Dept                                    | ERM             |                |
| Fax #                                   | 9556            |                |
| From                                    | Norma Castañeda |                |
| Co                                      | DOE/ERD         |                |
| Phone #                                 | 4226            |                |
| Fax #                                   | 4871            |                |

EPA Comments  
OU 6 Technical Memorandum #3 MODELING  
October 29, 1993

Generally speaking, the OU 6 model description falls short of the Interagency Agreement (IAG) requirements for model description. This tech memo needs to show that the model chosen is appropriate for use in estimating exposure concentrations for risk assessment. As such, it must include a summary of sources and types of data that will be used with the models, and the limitations, assumptions, and uncertainties of the proposed model insofar as they may affect the useability of results in risk assessment. The OU6 model description should indicate (through the data summary) how model inputs representative of site conditions will be obtained. Specific instances where the OU6 model description fails to provide this information for groundwater, surface water, and air models are addressed in the following general and specific comments.

## 1.0 CONCEPTUAL MODEL

### General Comments

1. The conceptual model should include at least a brief characterization of the contaminant sources present at OU6. For instance, this section lacks a discussion of whether any contaminants are likely to be present as immiscible phases in the subsurface, or what evidence is available to discount this possibility. If contaminants are likely to be present as dense nonaqueous phase liquids, the scope of the modeling effort will have to be expanded to consider multiple pathways at each subsite, particularly some that involve subcropping sandstones

2. The intent of Section 2.0, General Conceptual Model of Operable Unit 6, is to identify and describe potential exposure scenarios for present and future human receptors in OU6. The exposure pathways should be updated as necessary to be consistent with tech memo 2 for OU6.

## 2.0 GROUNDWATER MODEL

### General Comments

1 The limitations, assumptions, and uncertainties associated with the use of the ONED3 groundwater model at OU6 have not been provided, as required by the IAG. The OU6 shallow groundwater system is a variably saturated, heterogeneous, anisotropic, unconfined aquifer of limited extent. Most of the various contaminant sources at OU6 are unlikely to fully penetrate the aquifer. Application of the model ONED3 to the shallow groundwater system at OU6 will violate most of ONED3's underlying

assumptions, as listed in the ONED3 model documentation. The model assumes:

- A uniformly porous confined aquifer
- A homogenous and isotropic aquifer with respect to its hydraulic and transport characteristics
- A semi-infinite aquifer in extent (in the positive x-direction) of constant thickness
- A source fully penetrates the aquifer
- A fully saturated groundwater flow regime
- One-dimensional, steady-state, uniform, regional flow away from the source,
- The density and viscosity of the solute in the source and in the aquifer are identical and do not change with time
- No solute advection or dispersion into or out of the confining layers

The OU6 model description must list the model's underlying assumptions, discuss how violating the assumptions will affect the model results, show how uncertainty will be accounted for, and provide a justification for selecting this model for risk assessment purposes despite the disparity between assumed and actual conditions.

4.2 2. The IAG requires that the model description include a summary of the data to be used with the model. The only information provided is the parameter values and ranges in Table 3-1. This table consists of textbook values. Table 3-1 should be replaced with tables that summarize field-derived or locally representative values of hydraulic conductivity, effective porosity, and bulk density, if they are available. If not, it should be explained where these parameters will be obtained and why they will be adequately representative of site conditions.

The OU6 model description gives no information on how the contaminant source terms will be configured in time and space and how this information will be input into ONED3. This information is critical to the model description and should be briefly explained here.

Finally, an adequate description of the model should show locations and distances of groundwater pathlines, discharge points to surface water or human receptors, and the length of time the simulations will be run.

4.3 3 ONED3's governing equations and initial and boundary conditions should be presented in this document or specific references provided. The governing equations and initial and boundary conditions constitute the mathematical framework of a model and are an integral part of the model description. This information is necessary for model evaluation.

#### Specific Comments

4.4 4. Section 3.2.1, Page 3-3, Paragraph 1: The text states "available site-specific data and fate and transport parameters, source areas, and hydrogeologic conditions will be integrated using ONED3 to simulate the fate and transport of dissolved-phase contaminants in the saturated zone from source areas through the alluvium and colluvium, to discharge points along Walnut Creek."

This statement appears to discount the possibility that contaminants can move from alluvium and colluvium into subcropping sandstones and then discharge into Walnut Creek. This situation exists in nearby portions of OU2 in hydrogeologic settings similar to portions of OU6. This situation must either be accounted for or a justification provided for concluding that the bedrock pathways can be neglected without jeopardizing the utility of the model results. In addition, the sources of the site-specific data on fate and transport parameters, source areas, and hydrogeologic conditions should be provided. A summary of these data would be useful in this document.

4.5 5. Section 3.2.1, Page 3-3, Paragraph 2: The text states "contaminant fate and transport will also be evaluated using water balance and chemical mass balance analyses as a check for the reasonableness of the ONED3 results." The sources and validity of data for each component of the water and mass balance should be discussed.

### 3.0 SURFACE WATER MODEL

#### General Comments

5.1 1. The surface water model description lacks a clear definition of the model inputs. The text only states "model inputs will be a time series of precipitation and groundwater seep flows/loads" and "the time step is anticipated to be daily, or possibly smaller as appropriate to describe rainfall/runoff and erosional processes." The OU6 model description should indicate how data will be input into the model and include a discussion of the data sources and time step(s) to be used, and the types and recurrence intervals of storm events to be simulated. It should also discuss how seepage and base flow will be determined and input.

5.2 2. The model description must specify what data will be used with the model and the sources from which it will be obtained. Table 3-2 appears to list value ranges that can be input to the model for each model parameter but does not indicate values that

reflect actual site conditions at OU6. Table 3-2 should include available field-derived values for the model parameters as well as the contamination input values and other boundary conditions or show where adequately representative values for these parameters will be obtained.

5.3 3. The major contaminant transport and hydrologic equations used by the model should be presented in this report or specific references provided for where they can be obtained.

#### Specific Comments

5.4 4. Section 3.3.1, Page 3-6, Paragraph 3: The flow routing technique used with HSPF9 assumes complete mixing in all surface impoundments. However, if larger lakes or reservoirs with seasonal stratification are being simulated with HSPF9, then this model would not accurately handle pollutant fate and transport mechanisms. Therefore, this model should only be used for portions of watersheds that do not contain stratified impoundments.

5.5 5. Table 3-2: The partitioning coefficient between dissolved and suspended states (KDJ) is listed as having no units. If defined like other commonly used partitioning coefficients, this should have actual units. Actual units should be listed on this table, or this parameter should be more explicitly defined.

5.6 6. Table 3-2. The partitioning coefficient (KDJ) has a range of values listed as "0-1". However, many contaminants exhibit ratios between dissolved and suspended states that would be much greater than 1. Either this software is incapable of handling partitioning of many contaminants or this range is incorrectly listed. Therefore, either the table listing should be corrected, or the parameter definition should be explicitly stated, or the model has a very limited range of usage that excludes many organic contaminants.

### 4.0 AIR TRANSPORT AND DISPERSION MODELS

#### Specific Comments

6.1 1. Section 3.5.1, Pages 3-13 and 3-14. The Box Model is proposed to calculate contaminant concentrations under the following two scenarios: (1) the transport of volatile organic compounds into a building and (2) the transport of particulate matter to on-site receptors.

The Box Model may not be the most appropriate choice for either scenario. In scenario number 1, the Box Model may not accurately estimate concentrations for an enclosure such as a building. Under these conditions, it may be difficult to accurately estimate the mean wind speed, a critical mathematical parameter in the Box Model.

In scenario number 2, other models such as the Industrial Source Complex Short Term (ISCST) may yield more accurate estimates than the Box Model. This is especially true if the distance from the emission source (the contaminated soil) and the receptors exceeds 100 meters.

62 2. Section 3.5.1, Pages 3-13 and 3-14. The Fugitive Dust Model (FDM) is proposed to calculate contaminant concentrations of particulate matter to off-site receptors. The FDM is a widely used model to derive exposure point concentrations. However, due to the complex algorithms used, the FDM is not as efficient as other models. This is particularly true when multiple contaminant sources are involved, which is possible in the present modeling. It can take days to complete one computer run. Also, EPA in Region 8 prefers the use of the ISCST model

6-3 3. Section 3.5, Pages 3-13 through 3-16 It is unclear if the modeled concentrations are calculated from the cumulative effects of all the defined sources. This document may calculate contaminant concentrations individually from the sources. The contaminant concentrations should be calculated from the aggregate effect of all the defined sources. Also, the OU6 model description did not, but should clearly define all input terms used for the Box and FDM models.

## 5.0 REFERENCES

Beljin, M.S., and van der Heijde, P.K.M. 1993. SOLUTE - Program Package of Analytical Models for Solute Transport in Groundwater. Hydrolink, Inc., Cincinnati, Ohio. June.

Interagency Agreement (IAG). 1991. Rocky Flats Federal Facility Agreement and Consent Order between the State of Colorado, the U.S. Environmental Protection Agency, and the U.S. Department of Energy. January.

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HAZARDOUS WASTE  
BR-4

Colorado Department of Health  
Hazardous Materials & Waste Management Division

Comments

on

TECHNICAL MEMORANDUM NO. 3

TO

FINAL PHASE 1 RFI/RI WORK PLAN

FOR

WALNUT CREEK PRIORITY DRAINAGE

OU-6

ROCKY FLATS PLANT

JULY, 1992

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General Comment: On the surface the selected air models will probably be acceptable for the OU6 area, however, the input data should be monitored carefully.

Specific Comments:

Section 3.2.1: The choice of ONED3 as a contaminant transport model needs more justification. The hydrologic conditions of the colluvium violate almost every assumption the model depends upon: uniformly porous, confined aquifer, homogeneous, isotropic, constant thickness, fully saturated, no density/viscosity differences between source and aquifer, no solute advection or dispersion into or out of the confined aquifer. The text should discuss why these assumptions can be ignored. ONED3 gives concentration as output, the water balance is totally irrelevant to the model. Is the use of this model entirely theoretical or will some of the results be compared to data?

In the second paragraph, page 3-3, it is stated that a water balance and chemical mass balance will be performed to check the reasonableness of the model results. It is not clear that the water balance is part of the conceptual model rather than a check on model output. There is no discussion of how the water balance will be done. What will be included? Very little field data exists for inflow and outflow, the methods used to estimate these flows differ in their complexity and accuracy. What will be done to check the reasonableness of the water balance estimate? The

method to be used for the chemical mass balance is not discussed either. What assumptions and data will be used to calculate the mass balance?

Section 3.5.2: The Model Selection Criteria Evaluation, Selection Criteria 3 and 4 on page 3-16 states, "... the FDM model has undergone considerable validation and verification.". While there has been a considerable amount of work done on and with the FDM model, neither the reviewer, nor the Air Pollution Control Division (APCD) staff, is aware that the model has been validated. The FDM is usable when applied to small areas of relatively flat terrain but does have problems with complex terrain. If the FDM is used, the 191 update version should be used.

Section 3.6: Under the Summary of Parameter Values on page 3-17, is a discussion of the meteorological data to be used. The "met" data from the site is validated, however, consideration should be given to working in the data collected by APCD's three sites on the perimeter of the plant. The data for these sites has been provided to the Plant and additional copies are available if requested from APCD. The data from 1992 would be better for use in the model than 1991, although either would be acceptable.

Table 3.1: In the table effective porosity and bulk density are listed but they are not used in ONED3, what model will they be used in?

Table 3-4: In this table under "Source" the document states, "RFP Site Environmental Report for 1990 (EG&G 1991a)" would be used for "Joint frequency distribution of stability class, wind speed and direction". There should be a later report which would be better.